OCRWM	DESIGN CALCULATION OR ANALYSIS COVER SHEET	1. QA: QA 2. Page 1

3. System	4. Document Identifier
Fuel Handling Facility	210-00C-FH00-00100-000-00A

5. Title

Vestibule and Cask Preparation Mechanical Handling Calculation

6. Group

Emplacement and Retrieval

7. Document Status Designation

☒ Preliminary ☐ Final ☐ Cancelled

8. Notes/Comments

An AP-2.14Q review is waived for this document because this is the initial issue of a preliminary calculation.

Attachments	Total Number of Pages
Attachment I – Vestibule Equipment Layout	1
Attachment II – Preparation Area & Main Transfer Maintenance Room Equipment Layout	1

RECORD OF REVISIONS

9. No.	10. Reason For Revision	11. Total # of Pgs.	12. Last Pg. #	13. Originator (Print/Sign/Date)	14. Checker (Print/Sign/Date)	15. QER (Print/Sign/Date)	16. Approved/Accepted (Print/Sign)	17. Date
00A	Initial Issue	42	42	N. Ambre SIGNATURE ON FILE 5/25/04	B. Dianda SIGNATURE ON FILE 5/25/04	A. Barnes SIGNATURE ON FILE 5/26/2004	M. LaFountain SIGNATURE ON FILE 5-26-04	5-26-04

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ACRONYMS

BSC	Bechtel SAIC Company, LLC
HVAC	Heating Ventilation and Air Conditioning
WP	Waste Package
MSC	Monitored geologic repository Site-specific Cask
MCO	Multi-Canister Overpack
FHF	Fuel Handling Facility
DTF	Dry Transfer Facility
CHF	Canister Handling Facility
DPC	Dual-Purpose Canister

ABBREVIATIONS

psi	Pounds per square inch
lb	Pounds
mm	millimeter
kips	10^3 Pounds
ft	feet
in	inches

1. PURPOSE AND SCOPE

The scope of this document is to develop the size, operational envelopes, and major requirements of the equipment to be used in the vestibule, cask preparation area, and the crane maintenance area of the Fuel Handling Facility. This calculation is intended to support the License Application (LA) submittal of December 2004, in accordance with the directive given by DOE correspondence received on the 27th of January 2004 entitled: *Authorization for Bechtel SAIC Company L.L.C. to Include a Bare Fuel Handling Facility and Increased Aging Capacity in the License Application, Contract Number DE-AC28-01RW12101* (Ref. 167124). This correspondence was appended by further correspondence received on the 19th of February 2004 entitled: *Technical Direction to Bechtel SAIC Company L.L.C. for Surface Facility Improvements, Contract Number DE-AC28-01RW12101; TDL No. 04-024* (Ref. 168751). These documents give the authorization for a Fuel Handling Facility to be included in the baseline. The limitations of this preliminary calculation lie within the assumptions of section 5, as this calculation is part of an evolutionary design process.

2. QUALITY ASSURANCE

This calculation was prepared in accordance with AP-3.12Q, *Design Calculations and Analyses* (Ref. 168413). The Cask Preparation System has two major functions/subsystems that are classified as Safety Category (SC). These functions/subsystems are Cask Handling and the Trolley (Ref. 165179, Table A-2), which are two functions that are performed by the Fuel Handling Facility. The Cask Receipt and Return System has two major functions/subsystems that are classified as Safety Category (SC). These functions/subsystems are Cask Receipt and Cask Preparation (Ref. 165179, Table A-2), which are two functions that are performed by the Fuel Handling Facility. Therefore, this calculation is subject to the requirements of the *Quality Assurance Requirements and Description* document (Ref. 168669).

3. USE OF SOFTWARE

Computer software used in this technical product is classified as exempt from procedure LP-SI.11Q-BSC, Rev. 0, ICN 0, *Software Management*. All exempt software used in this calculation (Microsoft Excel 2000, Microsoft Visio Professional 2002, Microstation v. 07.01.04.07) is listed under sections 2.1.1 and 2.1.2, Exemptions, of LP-SI.11Q-BSC, Rev. 0, ICN 0, *Software Management* (Ref. 168412). Calculations are documented for checking by hand.

4. INPUTS

4.1 DATA AND PARAMETERS

4.1.1 Transport Cask Impact Limiter Dimensions

Impact Limiter Dimensions are presented in the following table:

Table 1: Transport Cask Impact Limiter Dimensions

Impact Limiter Type	Outer Diameter (in)	Length (in)
NAC-LWT [1] (upper)	65.25	27.8
NAC-LWT [2] (lower)	60.25	28.3
GA-4 [3] (upper/lower)	90	44.9
TN-68 [4] (upper/lower)	144	48
NAC-STC [5] (upper/lower)	124	44
HI-STAR [6] (upper/lower)	128	60
TS-125 [7] (upper/lower)	143.5	80
GA-9 [8] (upper/lower)	90	44.9
NAC-UMS [9] (upper/lower)	124	43

(1) Drawing No. 5 of the NAC-LWT Transport SAR Rev. 33 (Ref. 160755)
(2) Drawing No. 6 of the NAC-LWT Transport SAR Rev. 33 (Ref. 160755)
(3) Pages 1.2-7 & 1.2-8 of the GA-4 Transport SAR Rev. H (Ref. 103042)
(4) Drawing No. 972-71-2 of the TN-68 Transport SAR Rev. 4 (Ref. 160746)
(5) Drawing Nos. 209 & 210 of the NAC-STC Transport SAR Rev. 14 (Ref. 169362)
(6) Sheet 4 of Drawing No. C1765 of the HI-STAR Transport SAR Rev. 10 (Ref. 169235)
(7) Drawing No. FS-220 of the TS-125 Transport SAR Rev. 3 (Ref. 160757)
(8) Drawing No. 031300 of the GA-9 Transport SAR Final Design Report (Ref. 104776)
(9) Drawing Nos. 209 & 210 of the NAC-UMS Transport SAR Rev. UMST-02E (Ref. 164612)

4.1.2 Transport Cask/WP/MSC Lift Yoke Dimensions

The Transport Cask/WP/MSC Lift Yoke is 13'6" x 2'4" x 12'10" (Ref. 168931).

4.1.3 Waste Package Lifting Yoke Dimensions

The Waste Package Lift Yoke is 13'6" x 2'4" x 11'2" (Ref. 168932).

4.1.4 Standard Railcar

The largest railcar to be admitted by the Fuel Handling Facility has an overall length of 78 feet 6 inches, a deck width of 10 feet 8 inches, and a deck height of 55 inches (Ref. 166136, p. A19626)

4.1.5 Import/Export Trolley

The import/export trolley used to move the Transport Casks, Waste Packages, and MSCs from the Vestibule through the Preparation Area and into the Main Transfer Area is 20 feet in length, 12 feet in width, has a deck height of 5 feet, and an overall height with load of 26 feet 3 inches (Ref. 168043).

4.1.6 Waste Package Pedestals

Three different pedestal frames are required for proper vertical positioning of the unequal-length Waste Packages upon the import/export trolley. These three pedestal frames are 12 feet square, with heights of 80.7 inches, 11.6 inches, and 19.7 inches (Ref. 169158). All pedestal frames are placed below a common locking plate, which is 12 feet x 12 feet x 49.5 inches (Ref. 169158). A set of three pedestal frames may be stacked to a sum of their heights, or 112 inches. Therefore, a set of pedestals occupies a space of 12 feet x 12 feet x 112 inches (9ft 4in).

4.1.7 Docking Ring Attachment/Removal Operation

The overhead crane which aides docking ring attachment/removal has a necessary capacity of 20 tons (Ref. 169335).

4.1.8 NAC-STC Outer Lid Diameter and Weight

The outer lid of the NAC-STC has a diameter of 85.7 inches (Ref. 169362, Drawing No. 805) and a weight of 8,120 pounds (Ref. 169362 p. 2.2-3).

4.1.9 Naval Transport Cask Length

The length of the Navy rail-based Transport Cask is 234 inches (Ref. 165219, p. 25).

4.2 CRITERIA

4.2.1 Provide the required space, layout, and structures required for waste handling operations to receive and package commercial, U. S. Department of Energy (DOE) and U. S. Navy spent nuclear fuel (SNF), and DOE high level waste (HLW) for emplacement in the Geologic Repository (Ref. 163904, Section 1.4-1).

4.2.2 Protect the MSCs within the FHF from the external environment (Ref. 161362, Section 4.2.2.2).

4.2.3 Limit the consequences of off-normal conditions and event sequences (Ref. 161362, Section 4.2.2.2).

4.2.4 Provide design features to ensure that worker and public radiation doses are ALARA (Ref. 163904, Section 2-3-1).

4.2.5 Provide design features to control the spread of contamination within and from the facility (Ref. 163904, Section 1.1-6).

4.2.6 Provide safe work areas with a suitable environment for personnel and equipment to support operations and maintenance (Ref. 166275, PRD-022/T-001).

4.2.7 Provide the required space and layout in support of life safety and emergency response (Ref. 166275, PRD-022/T-001).

4.2.8 Provide the required space and layout for tools and equipment (Ref. 163904, Section 1.4.2-3).

4.2.9 Provide features that facilitate decontamination and dismantlement of the facility (Ref. 104787, 10 CFR 20.1406).

4.2.10 Provide the required space and layout in support of inspection, testing, calibration, and maintenance activities (Ref. 163904, Section 1.4.2-3).

4.2.11 Provide the space and layout for systems and utilities as required to support waste handling operations (Ref. 163904, Section 1.4.2-2).

4.2.12 Interface with GROA facilities as required to support related waste handling operations (Ref. 163904, 1-4).

4.2.13 Provide design features to preclude moderator intrusion into criticality sensitive areas (Ref. 163904, Section 1.4.1.2.9-9).

4.2.14 The facility has the capability at initiation of operations to receive and transfer vertical dual purpose canisters to the aging facility in an MSC. The facility does not have the capability at initiation of operations to receive and process Dual Purpose Canisters (DPC) containing CSNF to emplacement; this capability may be added at a future date (Ref. 167124, Enclosure).

4.2.15 FHF shall consist of a large Transfer Cell with a single entrance/exit shield door and appropriate support mechanical & electrical utilities and ventilation systems. FHF design shall be based on the concept of the TAN-607 Hot Shop currently in use at the INEEL site. The cell will be subdivided as needed to maintain function and contamination control (Ref. 168721, p. 1).

4.2.16 FHF shall have a single 200 / 15 Ton overhead bridge crane (single failure proof CMAA NOG 1 fuel handling / lifting device) with appropriate lift sets (grapples, spreaders, bales, and other accessories) for handling the transportation casks. The crane shall be capable of safely handling loaded transportation casks, MSCs, and WPs. Additional cranes will be used in the facility for transferring waste from a transportation cask / MSC into a designated waste package via a dry handling process, performing removal of impact limiters and personnel barriers, supporting closure cell operations, and for permitting certain maintenance and process operations such as removing shielding plugs, port plugs and canister lids. The 200-ton crane will deliver a sealed Waste Package to the load-out area for placement on the waste package transporter in order to accomplish transport from the FHF to a final emplacement position underground (Ref. 168721, p. 1).

4.2.17 FHF shall contain a small Crane Maintenance Cell attached to the FHF Transfer Cell. The Crane Maintenance Cell will be separated from the Transfer Cell by shield door(s) such that the crane may be manually retrieved, placed in the crane maintenance cell, and normal crane maintenance may be performed in a lower radiation environment (Ref. 168721, p. 1).

4.2.18 FHF shall contain one Waste Package Closure Cell (weld cell). The WP Closure Cell shall be designed to the extent practical to utilize the same standard WP Closure Cell equipment designs as will be used in the Dry Transfer Facility and Canister Handling Facility (Ref. 168721, p. 1).

4.2.19 FHF shall include strategically placed wall-mounted manipulators, viewing windows, CCTV cameras, glove boxes, service outlets, and remotely located controls, and associated services required to serve the FHF Transfer Cell and WP Closure Cell (Ref. 168721, p. 1).

4.2.20 FHF shall also have a vestibule at the front of the Transfer Cell that will provide for enclosure of the shield door and also provide for weather protection of the rail car or truck trailer that is transporting waste packages or transportation casks. Impact limiters and personnel barriers will be removed in this area (Ref. 168721, p. 1).

4.2.21 FHF shall be designed to receive and handle Transportation casks containing Commercial Spent Nuclear Fuel (CSNF), Department of Energy Spent Nuclear Fuel (DOE SNF) except MCOs, and Department of Energy High Level Waste (DOE HLW). The Fuel Handling Facility shall be designed to receive all aforementioned waste types upon delivery by legal weight truck (LWT), Overweight Trucks (OWT), or railcar (Ref. 168721, p. 1).

4.2.22 FHF shall be designed to receive and handle Dual Purpose Canisters (DPCs) containing CSNF (Ref. 168721, p. 1).

4.2.23 FHF shall be designed to receive and handle Navy or Department of Energy (DOE) standard canisters containing waste (Ref. 168721, p. 1).

4.2.24 FHF shall be designed to receive and handle new empty Waste Packages. Waste Packages shall be received on a rail or truck conveyance (Ref. 168721, p. 1).

4.2.25 FHF shall be designed to receive and handle new empty MGR Site Specific Casks (MSCs) for aging waste (Ref. 168721, p. 1).

4.2.26 FHF shall be designed to receive and handle various required support equipment for the processing and handling of the various shipping casks / devices, the overhead handling equipment, and the mechanical/electrical services required to support the various operations contained within the FHF (Ref. 168721, p. 1).

4.2.27 FHF shall be designed to handle and prepare empty Transportation Casks, loaded Waste Packages, and loaded MSCs for removal from the FHF facility (Ref. 168721, p. 1).

4.2.28 FHF shall be designed to handle only one transportation cask or MSC at a time for unloading and one WP or MSC for loading at a time (Ref. 168721, p. 2).

4.2.29 FHF ventilation systems design shall be based on cascading airflow from an area of lower contamination potential to an area of higher contamination potential. Therefore, diesel engine prime movers (truck cabs or rail locomotives) shall not be used within the vestibule that will serve as the transportation airlock (Ref. 168721, p. 2).

4.2.30 FHF Transfer Cell will be isolated from the adjacent vestibule level to avoid the spread of contamination to broad areas of the facility. A survey and cleanup of the secondary area where personnel enter will be made after each loading evolution (Ref. 168721, p. 2).

4.2.31 FHF shall be designed such that the facility can be constructed and made operational by the end May of Calendar year 2010 (Ref. 168721, p. 2).

4.2.32 FHF design shall not be based on any specific throughput requirements (Ref. 168721, p. 2).

4.2.33 FHF design shall not include receipt of any DOE Multi-canister Overpack (MCO) SNF (Ref. 168721, p. 2).

4.2.34 The FHF will include manipulators at various locations to serve the Transfer Cell and dry waste remediation work may be performed within the FHF Transfer Cell (Ref. 168721, p. 2).

4.2.35 FHF shall have the capability to remotely perform WP radiological surveys (Ref. 168721, p. 2).

4.2.36 FHF will have decontamination systems. WPs will be surveyed and decontaminated per the Functional and Operational requirements. In the event that the transportation casks, MSCs, and waste packages is found to have surface contamination, decontamination shall be performed by the limited capability afforded in the FHF (Ref. 168721, p. 2).

4.2.37 Internal cask cleanout is not currently anticipated as a function within the FHF. FHF shall not have the capability for cask flushing, but must be capable of removing fissile material to support transport requirements (Ref. 168721, p. 2).

4.2.38 FHF will not be connected to the on-site buffer facilities, i.e., to the Site Rail Transfer Cart (SRTC) system. To do so would require the laying of additional track in the building (SRTC runs on a wider track) and the distance from the cask receiving is substantial. The FHF will be designed to receive truck and rail conveyances directly and will not go through the intermediate SRTC transfer step (Ref. 168721, p. 2).

4.2.39 MCOs will not be handled in the FHF as currently designed. The MCOs constitute the most restricted handling scenario due to the need to keep lift heights (drop heights) to a very small distance (2 foot maximum). By precluding MCO handling from FHF, the overall lift height restrictions can potentially be relaxed from the current 6 foot maximum. If MCOs are desired to be handled at FHF in the future, addition of energy

absorbing decking around all lift points to minimize the drop height may be possible (Ref. 168721, p. 2).

4.2.40 Support site infrastructure (roads and rail services) and services including electrical power, water and fire utilities, central control center, security, etc. shall be available to support the construction and operation of FHF (Ref. 168721, p. 2).

4.2.41 Water services and any other materials that act as a moderator will be excluded to the extent practical from both the FHF Transfer Cell and WP Closure Cell since these two cells will have fissile materials present. Fire protection for these two areas will consist of strict control of combustible materials and passive design features (Ref. 168721, p. 2).

4.2.42 The transportation cask impact limiters and personnel barriers will be removed and stored outside the FHF Transfer Cell (Ref. 168721, p. 2).

4.2.43 FHF shall be sized such that adequate lay down is available for the FHF WP Closure Cell equipment and cask welding, inspection equipment etc. In addition FHF shall be sized with consideration given for adequate lay down for crane / lifting device grapple sets, rigging, slings, fixtures, and tooling, and various other auxiliary items required to perform the required functions within the FHF Transfer Cell (Ref. 168721, p. 2).

4.2.44 Transportation cask turnaround time from receipt from the national transportation system to return to the national transportation system is expected to be greater than 7 days (Ref. 168721, p. 3).

5. ASSUMPTIONS

5.1 ASSUMPTION ONE

Assumption– Nine types of nuclear waste transport casks are to be received by the Fuel Handling Facility. These casks are presented in table 2:

Table 2: Transport Cask Information

Transport Cask	Cask Payload	Vendor	Max. Loaded Wt. (lb)	Impact Limiter Wt. (lb)
NAC-LWT	CSNF	NAC	48,353[1]	2,855[2]
GA-4	CSNF	General Atomic	48,792[3]	5,733[4]
TN-68	CSNF	Transnuclear	227,400[5]	33,600[6]
NAC-STC	CSNF	NAC	231,970[7]	17,730[8]
NAC-STC	DPC	NAC	231,970[9]	17,730[10]
HI-STAR	DPC	Holtec	243,745[11]	36,418[12]
TS-125	DPC	BNFL FuelSolutions	242,831[13]	35,332[14]
GA-9	CSNF	General Atomic	47,840[15]	5,826[16]
NAC-UMS	CSNF	NAC	237,330[17]	17,692[18]
Naval Rail Cask	unavailable	Navy	400,000[19]	unavailable

(1) Tables 2.2.0-1and 2.2.0-2 of the NAC-LWT Transport SAR Rev. 33 (Ref. 160755)
(2) Table 2.2.0-1 of the NAC-LWT Transport SAR Rev. 33 (Ref. 160755)
(3) Table 2.2-1 of the GA-4 Transport SAR Rev. H (Ref. 103042)
(4) Table 2.2-1 of the GA-4 Transport SAR Rev. H (Ref. 103042). This value includes a 1,808lb support structure.
(5) Table 2-6 of the TN-68 Transport SAR Rev. 4 (Ref. 160746)
(6) Table 2-6 of the TN-68 Transport SAR Rev. 4 (Ref. 160746)
(7) Table 2.2.0-1 of the NAC-STC Transport SAR Rev. 14 (Ref. 169362)
(8) Table 2.2.0-1 of the NAC-STC Transport SAR Rev. 14 (Ref. 169362)
(9) Table 2.2.0-1 of the NAC-STC Transport SAR Rev. 14 (Ref. 169362)
(10) Table 2.2.0-1 of the NAC-STC Transport SAR Rev. 14 (Ref. 169362)
(11) Table 2.2-2 of the HI-STAR Transport SAR Rev. 10 (Ref. 169235)
(12) Table 2.2-2 of the HI-STAR Transport SAR Rev. 10 (Ref. 169235)
(13) Table 2.2-1 of the TS-125 Transport SAR Rev. 3 (Ref. 160757)
(14) Table 2.2-1 of the TS-125 Transport SAR Rev. 3 (Ref. 160757)
(15) Table 2.2 of the GA-9 Transport SAR Final Design Report (Ref. 104776)
(16) Table 2.2 of the GA-9 Transport SAR Final Design Report (Ref. 104776). This value includes a 1,826lb support structure.
(17) Table 2.2-2 of the NAC-UMS Transport SAR Rev. UMST-02E (Ref. 164612)
(18) Table 2.2-2 of the NAC-UMS Transport SAR Rev. UMST-02E (Ref. 164612)
(19) Page 26 of the *Naval Nuclear Propulsion Program Technical Baseline Compliance Document* (Ref. 165219)

Rationale– NUHOMS Transport Casks will not be accepted by the FHF. This is due to the horizontally actuated rams required to remove the canistered fuel from the cask. This requires an entirely different fuel handling approach that is atypical from all other Transportation Casks. Texas Long spent nuclear fuel will also not be accepted by FHF due to its size. The FHF facility is designed for the Transport Casks mentioned in Table 2 because of their commercial availability and current use. The FHF does not have any throughput requirement (see section 4.2.32), and has few requirements stipulating the types of Transport Casks it shall receive (see sections 4.2.1, 4.2.14, 4.2.21, 4.2.22, 4.2.23,

4.2.25, & 4.2.33). The FHF does however, have a required operational date of the end of May of Calendar year 2010 (see section 4.2.31). The aim of FHF is to have the broadest capability for fuel/canister handling while meeting this requirement, as well as being based upon the broad functionality of the TAN-607 Hot Shop currently in use at the INEEL site (see section 4.2.15).

5.2 ASSUMPTION TWO

Assumption– The receipt and return functions of the Fuel Handling Facility are based upon the functions outlined by the Dry Transfer Facility level 2 Block Flow Diagrams for the Cask Receipt and Return System (Ref. 168964). These functions are included in the following outline:

I. Transport Cask Receipt and acceptance from off-site

1. Transport Cask received on truck/railcar from off-site, initially inspected & surveyed, and transported to the Fuel Handling Facility
2. Authority given to the Cask/MSC/WP Preparation System for pre-transfer preparation

II. Empty Waste Package receipt and acceptance from Non-Nuclear Handling

1. Perform initial inspections of Waste Package
2. Accept Waste Package from Non-Nuclear Handling
3. Authority given to Cask/MSC/WP Preparation System for pre-transfer preparation

III. Conveyance Staging

1. Stage empty Conveyance in rail yard/staging area and wait for Cask Return

IV. Post-transfer Transport Cask Return

1. Empty Conveyance moved from rail yard/staging area to Vestibule
2. Empty Transport Cask is received from the Transport Cask/MSC Preparation System upon import/export trolley
3. Transport Cask and attached impact limiters is placed upon its empty Conveyance
4. Perform radiological survey upon the cask and its conveyance
5. Perform decontamination as necessary

6. Perform security check

7. Loaded Conveyance is transported off-site

Rationale– The major operations outlined by the Dry Transfer Facility level 2 Block Flow Diagrams for the Cask Receipt and Return System (Ref. 168964) are listed in the above outline as roman numerals I – IV. The Fuel Handling Facility also performs the aforementioned operations, as the general facility functions of handling HLW/SNF and the production of emplacement-ready Waste Packages apply to both facilities. However, the Fuel Handling Facility must adhere to different criteria than the Dry Transfer Facility (for applicable criteria, see section 4), and therefore the receipt and return functions required for the operation of FHF will differ from those required by DTF. The major FHF departure from the operations outlined by the Dry Transfer Facility level 2 Block Flow Diagrams for the Cask Receipt and Return System is the absence of a Site Rail Transfer Cart (SRTC) system and SRTC Buffer Area. This is in accordance with the criteria expressed in section 4.2.38. See also sections 4.2.1, 4.2.21, 4.2.22, 4.2.23, .4.2.24, 4.2.25, and 4.2.27 for criteria involved with receipt and return operations.

5.3 ASSUMPTION THREE

Assumption– The Transport Cask, MGR Site Specific Cask (MSC), and Waste Package preparation functions of the Fuel Handling Facility are based upon the functions outlined by the Dry Transfer Facility level 2 Block Flow Diagrams for the Cask/MSC/WP Preparation System (Ref. 169135). These functions are included in the following outline:

I. Pre-transfer Transport Cask/MSC Preparation

1. Receive from Receipt and Return System

2. Remove Personnel Barrier (as needed)

3. Remove Impact Limiters (as needed)

    a. Perform Radiological Survey upon the Impact Limiters and store

4. Upright Transport Cask/MSC and place on import/export trolley

5. Prepare Transport Cask/MSC for waste transfer

II. Pre-transfer Waste Package Preparation

1. Receive Empty Waste Package from Receipt and Return System

2. Prepare Empty Waste Package for Loading

a. Install pedestal import/export trolley (if necessary)

b. Transfer Waste Package to import/export trolley

c. Install corresponding docking ring on the Waste Package

III. Post-transfer Transport Cask/MSC Preparation

1. Restore Transport Cask/MSC

a. Place Transport Cask/MSC on Conveyance

b. Perform exterior radiological survey on Transport Cask/MSC

c. Perform decontamination as needed

d. Retrieve and Install impact limiters (Transportation Casks only)

e. Export Transport Cask/MSC to Receipt and Return System

Rationale– The major operations outlined by the Dry Transfer Facility level 2 Block Flow Diagrams for the Cask/MSC/WP Preparation System (Ref. 169135) are listed in the above outline as roman numerals I – III. The Fuel Handling Facility also performs the aforementioned operations, as the general facility functions of handling HLW/SNF and the production of emplacement-ready Waste Packages apply to both facilities. However, the Fuel Handling Facility must adhere to different criteria than the Dry Transfer Facility (for applicable criteria, see section 4), and therefore the preparation functions required for the operation of FHF will differ from those required by DTF. The major FHF departure from the operations outlined by the Dry Transfer Facility level 2 Block Flow Diagrams for the Cask/MSC/WP Preparation System is the absence of a Site Rail Transfer Cart (SRTC) system. This is in accordance with the criteria expressed in section 4.2.38. Another departure is the lack of a Remediation System. There is no requirement for the FHF to have a Remediation System or remediation capabilities (see section 4). See also sections 4.2.1, 4.2.21, 4.2.22, 4.2.23, 4.2.24, 4.2.25, 4.2.27, and 4.2.28 for criteria involved with preparation operations.

5.4 ASSUMPTION FOUR

Assumption– The fuel transfer functions of the Fuel Handling Facility is based upon the functions outlined by the Dry Transfer Facility level 2 Block Flow Diagrams for the Spent Nuclear Fuel/High Level Waste Transfer System (Ref. 169136). These functions are included in the following outline:

I. Fuel Transfer Preparations

1. Cask/MSC Docking

2. DPC Cask Docking

3. Waste Package Docking

II. Waste Transfer

1. SNF transfer from Transport Cask [2]

a. SNF transfer to Waste Package

b. SNF transfer to MGR Site Specific Cask (MSC)

2.Canister transfer from Transport Cask

a. Canister transfer to Waste Package

b. Canister transfer to MGR Site Specific Cask (MSC)

3.DPC transfer from Transport Cask

a. DPC transfer to MGR Site Specific Cask (MSC)

III. Unloaded Transport Cask/MSC, loaded Waste Package export

1. Unloaded Transport Cask/MSC, loaded Waste Package preparation

a. Undock and Remove Waste Package docking ring

b. Undock and Remove Transport Cask/MSC docking ring

2. Transport Cask/MSC/Waste Package export

a. Unloaded Transport Cask/MSCs are moved from the Fuel Transfer Cell and received by Cask/MSC/WP preparation system

b. Loaded Waste Package are moved from the Fuel Transfer Cell and received by Waste Package Closure Cell

c. Sealed and Loaded Waste Package received from Waste Package Closure Cell

d. Trunnions are removed from Loaded and Sealed Waste Package, which is then received by the Emplacement System

(2) SNF transfer may also occur from an MSC to a Waste Package.

Rationale– The major operations outlined by the Dry Transfer Facility level 2 Block Flow Diagrams for the Spent Nuclear Fuel/High Level Waste Transfer System (Ref. 169136) are listed in the above outline as roman numerals I – III. The Fuel Handling Facility also

performs the aforementioned operations, as the general facility functions of handling HLW/SNF and the production of emplacement-ready Waste Packages apply to both facilities. However, the Fuel Handling Facility must adhere to different criteria than the Dry Transfer Facility (for applicable criteria, see section 4), and therefore the transfer functions required for the operation of FHF will differ from those required by DTF. There are two major FHF departures from the operations outlined by the Dry Transfer Facility level 2 Block Flow Diagrams for the Spent Nuclear Fuel/High Level Waste Transfer System. FHF does have access to the services of a Remediation System. There is no requirement for the FHF to have a Remediation System or remediation capabilities (see section 4). The second departure involves DPCs. The Fuel Handling Facility does not have the capability to cut open DPCs (see sections 4.2.14 and 4.2.22), and thereby cannot transfer the fuel contained within them to a Waste Package. See also section 4.2.16 for the criteria to use a dry transfer process.

5.5 ASSUMPTION FIVE

Assumption– Transport Cask Personnel Barriers are assumed to be rigid. Unless better information is available, the length of a Personnel Barrier is equal to the distance between the attached impact limiters, and the height and width of a personnel barrier is equal to the impact limiter outer diameter. The bounding case for personnel barrier size is arrived at using these assumptions, and is illustrated in Table 3:

Table 3: Personnel Barrier Information

Personnel Barrier Type	Length (in)	Width (in)	Height (in)	Necessary Floor Space (ft^2)
NAC-LWT[1]	238.5	96	96	159
TN-68[2]	175.08	144	144	175.1
Bounding Case	238.5	144	144	195.9

(1) Drawing No. 15 of the NAC-LWT Transport SAR Rev. 33 (Ref. 160755)
(2) Drawing No. 972-71-2 of the TN-68 Transport SAR Rev. 4 (Ref. 160746)

Rationale– The personnel barrier purpose is to prevent access to the overpack cylindrical surface. Personnel barriers are therefore necessary to restrict access to the surface of the cask that is actually exposed. Impact limiters naturally restrict access to the upper and lower portions of the Transport Cask, and therefore the space between the impact limiters is the region where personnel barriers are required. The NAC-LWT Transport Cask is transported with a large frame that encompasses it. To prevent personnel access, this frame needs to be covered in its entirety, yielding the 238.5 inch length value stated in table 3. The bounded case is supported by the NAC-LWT and TN-68 Transport Cask information shown above.

5.6 ASSUMPTION SIX

Assumption– The HI-STAR L-shaped cradle, which is used to upend/downend the HI-STAR Transport Cask, is dimensionally bounded at 244in. x 115in. x 115in.

Rationale– The HI-STAR L-shaped cradle dimensions are based upon 120% of the HI-STAR cask dimensions. The HI-STAR Transport Cask has a length of 203.25 inches, and an outer diameter of 96 inches (REF. 169235, Drawing No. 3913).

5.7 ASSUMPTION SEVEN

Assumption– Several different pedestal frames are necessary to position the different Transport Casks upon the Transport Cask trolley (Main Transfer Room) at a proper height. These pedestal frames are assumed to be 12 feet square, with varying heights. These pedestal frames are placed below a common locking plate for final positioning and securing. A set of Transport Cask pedestal frames may be stacked to a sum of their heights. Therefore, a set of pedestals occupies a floor space of 12 feet x 12 feet.

Rationale–The Transport Cask trolley must use interchangeable pedestals of the same overall size to interface properly with the trolley, regardless of the type of Transport Cask carried. The trolleys are all of the same size and capability as the import/export trolley described in section 4.1.6, and therefore would require pedestals capable of an identical interface, regardless of load.

5.8 ASSUMPTION EIGHT

Assumption– A pedestal frame is necessary to position the MSC upon the MSC trolley. These pedestal frames are assumed to be 12 feet square, with varying heights. This pedestal frame is placed below a common locking plate for final positioning and securing. An MSC pedestal frame occupies a floor space of 12 feet x 12 feet.

Rationale– The MSC trolley must use interchangeable pedestals of the same overall size to interface properly with the trolley, regardless of the type of load carried (see section 4.1.6). The trolleys are all of the same size and capability as the import/export trolley described in section 4.1.6, and therefore would require pedestals capable of an identical interface, regardless of load.

5.9 ASSUMPTION NINE

Assumption– The HI-STAR Transport Cask requires a yoke for horizontal lifting operations (Ref. 169235, Fig. 7.1.5). The I-beam type yoke utilizes twin lifting straps for horizontal handling of the HI-STAR Transport Cask. This yoke occupies a floor space measuring 244 inches in length by 115 inches in width.

Rationale– This yoke is sized according to the dimensions of the HI-STAR Transport Cask. The HI-STAR is 203.25 inches in length and 96 inches in diameter (Ref. 169235, Dwg. 3913). Adding an additional 20% for conservatism to these dimensions yields a space of 244 inches by 115 inches.

5.10 ASSUMPTION TEN

Assumption– The Vestibule has a usable floor space of 125ft x 59ft. It has a usable height of 54 feet 4 inches.

Rationale– The sizing of the Vestibule is an iterative process. This is a preliminary calculation, and these values were initial estimates obtained from the Plant Design group. The equipment envelopes will be fit upon these values, and further equipment or structural design recommendations will be made accordingly. These dimensions differ from the dimensions stated in Attachment I. The plan dimensions shown in Attachment I are taken directly from preliminary Plant Design Drawings.

5.11 ASSUMPTION ELEVEN

Assumption– The Preparation Area has a usable floor space of 61ft x 34ft. It has a usable height of 28 feet.

Rationale– The sizing of the Preparation Area is an iterative process. This is a preliminary calculation, and these values were obtained from the Plant Design group. The equipment envelopes will be fit upon these values, and further equipment or structural design recommendations will be made accordingly. Section 4.1.5 states that the import/export trolley has an overall height of 26 feet 3 inches. The usable height of the Preparation Area must be larger than this value, making 28 feet a reasonable height value.

5.12 ASSUMPTION TWELVE

Assumption– The Main Transfer Maintenance Room has a usable floor space of 61ft x 34ft. It has a usable height of 26 feet.

Rationale– The sizing of the Crane Maintenance Room is an iterative process. This is a preliminary calculation, and these values were obtained from the Plant Design group. The equipment envelopes will be fit upon these values, and further equipment or structural design recommendations will be made accordingly.

5.13 ASSUMPTION THIRTEEN

Assumption– An additional diameter of 40 inches is allocated for the outer diameters of the WP docking ring and the Transport Cask docking ring.

Rationale– Docking ring diameters have not been determined in any analysis, nor has any subcontractor submitted them. An additional diameter of 40 inches is deemed reasonable as 20 inches of additional diameter should prove sufficient for adapting to the port plug (docking features) and an additional 20 inches of outer diameter should prove sufficient for the major structural portions of the docking ring.

5.14 ASSUMPTION FOURTEEN

Assumption– The MSC docking ring is assumed to be no larger than the largest Transport Cask docking ring.

Rationale– Any of the larger Transport Casks are likely candidates for use as MSCs for the MGR. The Transport Casks allowed for receipt as stated in Table 2 are these likely candidates. The largest of these Transport Casks is therefore a good basis for sizing the MSC docking ring.

5.15 ASSUMPTION FIFTEEN

Assumption– The distance from the deck of a flatcar to the axial centerline (deck to the trunnion saddle centers) of the Naval rail Transport Cask is 6 feet 5 inches.

Rationale– The impact limiters of the Naval rail Transport Cask are 144 inches (12 feet) in diameter (Ref. 165219, p. 25). It follows from this value that the axial centerline of the Transport Cask will be a minimum of 6 feet from the deck of the railcar. Adding five inches of clearance yields a distance of 6 feet 5 inches.

5.16 ASSUMPTION SIXTEEN

Assumption– The trunnion axial centerlines of the Naval rail Transport Cask are inset 12 inches from the top and bottom surfaces of the Naval rail Transport Cask.

Rationale– Since the actual locations of the Naval rail Transport Cask trunnions are unknown, this is a case, which upon the uprighting of the cask, places the bottom of the cask 12 inches below the former horizontal axial centerline of the cask during transport. This case is used for the sizing of the Vestibule Gantry Crane.

5.17 ASSUMPTION SEVENTEEN

Assumption– The Mobile Elevating Platform requires a floor space of 20 feet by 4 feet.

Rationale– Readily available vendor information of similar pieces of equipment require this amount of floor space.

5.18 ASSUMPTION EIGHTEEN

Assumption– The Health Physics Station requires a floor space of 10 feet by 10 feet.

Rationale– This is an arbitrary assumption to include space for this station.

5.19 ASSUMPTION NINETEEN

Assumption– The Main Transfer Maintenance Room Hatch Cover requires a floor space of 12' 6" x 12' 6".

Rationale– The opening in the floor of the Main Transfer Maintenance Room is 12' x 12' (see section 6.3.2).

5.20 ASSUMPTION TWENTY

Assumption– The Gas Analysis Station located in the Main Transfer Maintenance Room requires a floor space of 6' x 6'.

Rationale– The required floor space for the Gas Analysis Station is a conservative assumption based upon conversations with ES&H personnel. The Gas Analysis Station is equipped with a computer terminal, hose storage, and connect/disconnects.

5.21 ASSUMPTION TWENTY-ONE

Assumption– The Tool Station located in the Main Transfer Maintenance Room requires a floor space of 8' x 5'.

Rationale– The required floor space for the Tool Station is a conservative assumption based upon conversations with ES&H personnel. The Tool Station will store all pneumatic impact equipment used for Transportation Cask bolt attachment/removal, as well as incorporate service air hookups for this equipment.

5.22 ASSUMPTION TWENTY-TWO

Assumption– The structural steel and concrete floor that separates the Preparation Area from the Main Transfer Maintenance Room requires a depth of 4 feet.

Rationale– The structural steel that supports the ceiling of the Preparation Area (floor of the Main Transfer Maintenance Room) is assumed to displace a vertical distance of 2 feet. The concrete floor of the Main Transfer Maintenance Room is assumed to displace a vertical distance of 2 feet. This is a preliminary calculation, and this structural height is typical for this type of building and building functionality.

5.23 ASSUMPTION TWENTY-THREE

Assumption– Typical slings have load paths that are not less than 45 degrees from the top of the load.

Rationale– This is typical for sling load rigging. A larger sling angle prevents undue stresses from being taken by the sling itself.

5.24 ASSUMPTION TWENTY-THREE

Assumption– The FHF is assumed to have the following basic layout, described pictorially with the locations of the rooms associated with this calculation:

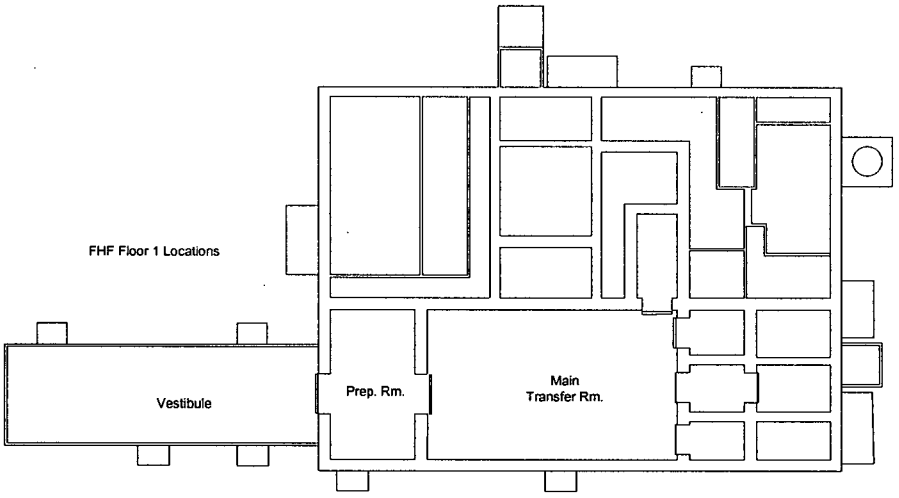


Figure 1: FHF 1st Floor Room Arrangement El. 0'

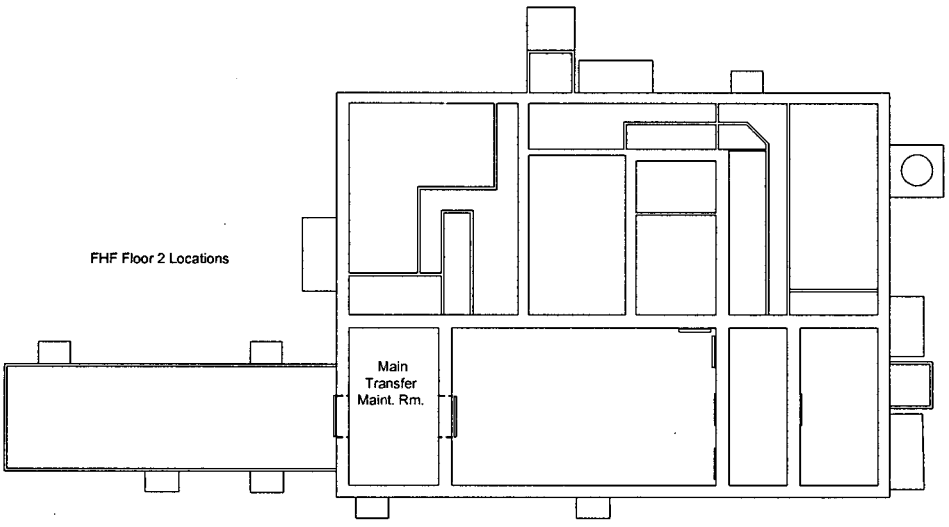


Figure 2: FHF 2nd Floor Room Arrangement El. 32'

Rationale– This is a preliminary calculation, and this layout was obtained from the Plant Design group. The necessary equipment envelopes will be fit upon this general layout, and

further equipment or structural design recommendations will be made accordingly. This layout supports the criteria outlined in sections 4.2.15, 4.2.17, 4.2.18, 4.2.20, and 4.2.30.

6. CALCULATION ANALYSIS

6.1 VESTIBULE

The Vestibule is the main entrance/exit area that receives/releases transportation casks and Waste Packages for the Fuel Handling Facility. This area of the facility satisfies the criteria of sections 4.2.1, 4.2.6, 4.2.8, 4.2.11, 4.2.20, 4.2.24, and 4.2.30.

6.1.1 Philosophy and Equipment

The Fuel Handling Facility requires an area that accepts MSCs, Waste Packages, and Transport Casks. Transport Casks will arrive in a horizontal orientation via truck or railcar, with personnel barriers and impact limiters attached. This area performs several receipt functions including acceptance, personnel barrier and impact limiter removal, cask offload, cask upending, and cask placement on a facility-specific transportation system. This area performs several release functions including cask removal, down ending from the facility-specific transportation system, and cask placement on the appropriate truck or railcar. This area also allows the final release of a loaded Waste Package for emplacement within Yucca Mountain.

6.1.1.1 Vestibule Gantry Crane

The Vestibule requires equipment that is able to lift the Transport Cask from its conveyance. It is also necessary to remove the impact limiters and personnel barrier from the Transport Cask prior to the lift from the conveyance. A gantry crane will be used for these operations. The Transport Cask with the largest weight determines the necessary capacity of the gantry crane. The Naval rail Transport Cask is the heaviest, at 400,000 pounds (see Table 4.1.1). A 200-ton capacity gantry crane is therefore recommended for the Vestibule. The size of the Vestibule Gantry Crane must also be determined.

The span of the Vestibule Gantry Crane is determined by the size of the Vestibule. The Vestibule is 59 feet in width (see section 5.10). This allows for a 51-foot rail span for the gantry.

The height of the Vestibule Gantry Crane is determined by the lift that requires the largest vertical displacement of the hook/yoke. This lift involves the Naval Rail Transport Cask, which is 19 feet 6 inches in length. The cask trunnions sit upon cask skid trunnion saddles, which are 6 feet 5 inches (see section 5.15) above the maximum deck height of 55 inches (see section 4.1.4). The trunnion centers are located 1 foot from the ends of the cask (see section 5.16). Transportation Casks are lifted using a lift yoke (see section 6.1.1.8), which has a height dimension of 11 feet 4 inches from the hook to the trunnion receiver center. These dimensions sum to yield a hook height of 39 feet 10 inches. Rounding this value to the nearest foot, and adding a foot of lift yields a necessary hook height of 41 feet. This necessary hook height for a

200-ton capacity gantry crane translates to an overall gantry crane height (top of rail to top of trolley) of 53 feet 4 inches, due to a 200-ton crane having a high-hook to top of trolley dimension of 12 feet 4 inches (Ref. 167191, p.72).

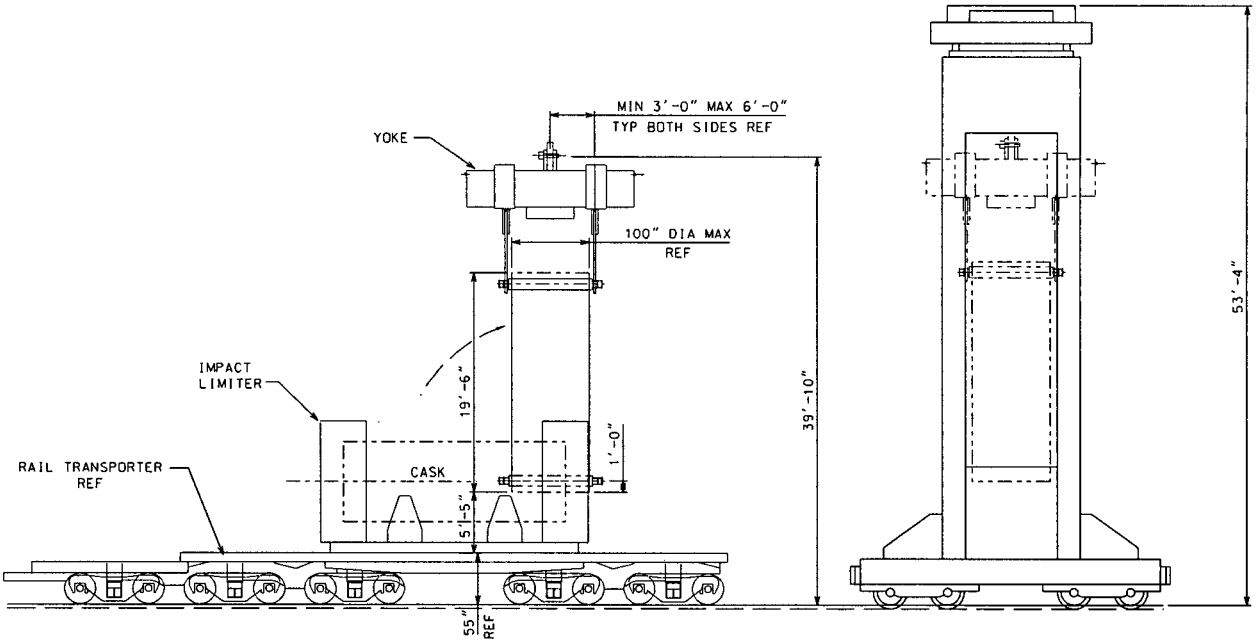


Figure 3: Vestibule Gantry Crane

For greater versatility, an auxiliary hoist with a smaller capacity will be used. This hoist will run from the same trolley as used by the main Vestibule Gantry Crane. This auxiliary hoist will be used for impact limiter removal, personnel barrier removal, and other miscellaneous duties within the Vestibule. A 30-ton capacity is recommended for this hoist, as many light-duty tasks, including impact limiter removal, are made possible by this hoist.

6.1.1.2 Mobile Elevating Platform

Transport Casks that arrive in the Vestibule are outfitted with a personnel barrier as well as impact limiters. This personnel barrier as well as the impact limiters must be unbolted from the conveyance prior to removal. The attaching bolts are at varying heights, some of which are out of personnel reach. The personnel barrier and impact limiter removal is made possible by personnel use of a (Actuated Boom) Man Lift, which is a mobile platform that can be adjusted to various heights. The Man Lift is highly mobile, and because of this reason, it will not be included to determine the space required for the Vestibule.

The Actuated Boom Man Lift also allows radiological surveys and possible area-specific light decontamination after/during the personnel barrier and impact limiter removal operations. This equipment must also adhere to the criteria expressed in 4.2.29.

6.1.1.3 Vestibule Outer Door

The Vestibule accepts Transport Casks through the Vestibule Outer Door. This door is sized to allow the Vestibule Gantry Crane access to the adjacent storage pad, accept Transport Casks and their conveyances, the Waste Package Emplacement Equipment, and any other equipment

required to support the Fuel Handling Facility. The Vestibule Gantry Crane is 53 feet 4 inches in overall height (see section 6.1.1.1). Giving a foot of clearance yields a door that is 54 feet 4 inches in overall height. The width of the Vestibule Outer Door is determined by the width, or span, of the Vestibule Gantry Crane. The Vestibule Gantry Crane has a 51-foot span (see section 6.1.1.1). Allowing a clearance of two feet on each side yields a door that is 55 feet wide.

The Vestibule Gantry Crane will have trolley hook approaches (main hook) of 7 and 9 feet (Ref. 167191, p. 72). It has an auxiliary hook approach that is offset 6 feet from the main hook approach (Ref. 167191, p. 72). The Vestibule Gantry Crane also has bridge hook approaches of 14 feet (Ref. 167191, p. 72). Refer to Attachment I.

The Vestibule Outer Door is negligible in the determination of space required for the Vestibule Equipment.

6.1.1.4 Personnel Barrier Lifting Device

The Transport Cask arrives through the Vestibule Outer Door on its conveyance, is stopped, and the brakes are set. The personnel barrier is removed using a Personnel Barrier Lifting Device, which is a four-point lifting sling. The impact limiters are removed next. This piece of equipment satisfies the criterion noted in section 4.2.42.

The Personnel Barrier Lifting Device is negligible in the determination of space required for the Vestibule Equipment, as slings and lifting straps are easily stowed or hung.

6.1.1.5 Impact Limiter Lifting Device

The Impact Limiters are removed using the Impact Limiter Lifting Device, which is a three-point lifting sling. In the case of the HI-STAR Transport Cask, the cask and its impact limiters are lifted together prior to impact limiter removal. This piece of equipment satisfies the criterion noted in section 4.2.42.

The Impact Limiter Lifting Device is negligible in the determination of space required for the Vestibule Equipment, as slings and lifting straps are easily stowed or hung.

6.1.1.6 HI-STAR Lift Yoke

The HI-STAR Transport Cask is removed from the railcar using a lift yoke that utilizes twin lifting straps that encompass the cask. This piece of equipment satisfies the criterion noted in section 4.2.21.

The dimensions of the HI-STAR Lift Yoke are as stated in section 5.9.

6.1.1.7 Cask Tilting Device

The HI-STAR Transport Cask arrives on a specialty railcar that does not allow the removal of the impact limiters. The cask and its impact limiters are lifted from the railcar prior to impact limiter removal. Both impact limiters are then removed prior to upending. The cask is then placed in a horizontal orientation upon the HI-STAR Upending/Downending Cradle and secured. The Cask Lift Yoke is then attached to the trunnions upon the Cask Tilting Device and the HI-

STAR Transport Cask is uprighted. This piece of equipment satisfies the criterion noted in section 4.2.21.

The dimensions of the Cask Tilting Device are as stated in section 5.6.

6.1.1.8 Cask Lift Yoke

An adjustable span between yoke saddles is necessary to accommodate the variety of Transport Casks that the FHF receives. An adjustable Cask Lift Yoke accomplishes this using actuated yoke saddles traveling upon a spreader beam.

The dimensions of the Cask Lift Yoke are as stated in section 4.1.2.

6.1.1.9 Waste Package Lift Yoke

An adjustable span between yoke saddles is necessary to accommodate the variety of Waste Packages that the FHF receives. An adjustable Waste Package Lift Yoke accomplishes this using actuated yoke saddles traveling upon a spreader beam.

The dimensions of the Waste Package Lift Yoke are as stated in section 4.1.3.

6.1.1.10 Cask Pedestal Lifting Device

The Cask Pedestal Lifting Device is a three-point sling used to place Transport Cask/MSC/WP pedestals upon the import/export trolley.

The Cask Pedestal Lifting Device is negligible in the determination of space required for the Vestibule Equipment, as slings and lifting straps are easily stowed or hung.

6.1.1.11 Transport Cask Pedestal Set

The Transport Cask Pedestal Set assures that the cask is placed upon the Transport Cask trolley at the proper height for fuel or canister transfer. The Vestibule is used as a staging area for the Transport Cask Pedestal Set. This pedestal set is not utilized for the proper height placement of the Transport Cask upon the import/export trolley, as the Transport Cask is lifted off of the import/export trolley and placed upon the Transport Cask trolley prior to waste transfer.

The Transport Cask Pedestal Set dimensions are as stated in section 5.7.

6.1.1.12 MSC Pedestal Set

The MSC Pedestal Set assures that the MSC cask is placed upon the MSC trolley at the proper height for fuel or canister transfer. The Vestibule is used as a staging area for the MSC Pedestal Set. This pedestal set is not utilized for the proper height placement of the MSC upon the import/export trolley, as the MSC is lifted off of the import/export trolley and placed upon the MSC trolley prior to waste transfer.

The MSC Pedestal Set dimensions are as stated in section 5.8.

6.1.1.13 Waste Package Pedestal Set

The Waste Package Pedestal Set assures that the Waste Package is placed upon the Waste Package trolley at the proper height for waste transfer in the Fuel Transfer Cell. The Vestibule is used as a staging area for the Waste Package Pedestal Set. This pedestal set is not utilized for the proper height placement of the Waste Package upon the import/export trolley, as the Waste Package is lifted off of the import/export trolley and placed upon the Waste Package trolley prior to waste transfer.

The Waste Package Pedestal Set dimensions are as stated in section 4.1.6.

6.1.1.14 Import/Export Trolley

The Import/Export Trolley is a rail-based transport system that moves Transport Casks, MSCs, and Waste Packages from the Vestibule through the Preparation Area, and into the Main Transfer Room. Upon entry into the Main Transfer Room, Waste Packages and MSCs are removed from the Import/Export Trolley and placed upon the corresponding trolley and pedestal for fuel transfer in the Fuel Transfer Cell. If the Transport Cask contains canistered fuel, the Transport Cask is placed in a bay within the Main Transfer Room alongside an MSC/Waste Package for transfer of the canister to the MSC/Waste Package.

The Import/Export Trolley dimensions are as stated in section 4.1.5.

6.1.1.15 Health Physics Station

The Health Physics Station is an area reserved for personal protective equipment (PPE) that may be required in the event of a contaminated area or waste vessel in the Fuel Handling Facility.

The Health Physics Station dimensions are as stated in section 5.18.

6.1.1.16 Preparation Equipment Door

The Preparation Equipment Door is located at the end of the Vestibule that borders the rest of the Fuel Handling Facility. The Import/Export Trolley is the largest piece of equipment that passes through this door. With a TS-125 Transport Cask the Import/Export Trolley is 26 feet 3 inches in overall height (see section 4.1.5). With a clearance of 1 foot, the required door height is 27 feet 3 inches. The import/export trolley has a width of 12 feet (see section 4.1.5). This width, in addition to a clearance on both sides of 1 foot, yields a minimum door width of 14 feet.

The Preparation Equipment Door is negligible in the determination of necessary floor space.

6.1.2 Space Required for Vestibule Equipment

A sketch was used to determine if the necessary equipment fits within the equipment envelope stated in section 5.10. All necessary equipment fits within this stated envelope and is able to be lifted via the Vestibule Gantry Crane, as shown in Attachment I. Many pieces of equipment will not be necessary for all operations that take place in the Vestibule. These pieces of equipment can be either removed to a storage facility or placed outside until they are required.

6.2 PREPARATION AREA

The Preparation Area is an area that prepares Transport Casks, Waste Packages, and MSCs for waste transfer in the Fuel Transfer Bay. This area of the facility satisfies the criteria of sections 4.2.1, 4.2.6, 4.2.7, 4.2.8, and 4.2.11.

6.2.1 Philosophy and Equipment

The Fuel Handling Facility requires an area that performs gas sampling, inert gas filling, survey operations, decontamination operations, docking ring attachment and removal, and cask lid preparation for the Transport Casks that are received.

6.2.1.1 Main Transfer Room Equipment Door

The Preparation Area requires a door for conveyances and their loads, personnel, and other supporting equipment to enter the Main Transfer Room. This door requires minimum dimensions that allow for the import/export trolley with the longest up righted Transport Cask access to the Preparation Area. The largest piece of equipment that uses this door is the import/export trolley. The import/export trolley has a maximum height of 26 feet 3 inches while carrying the TS-125 Transport Cask (see section 4.1.5). This height, in addition to a clearance of 1 foot, yields a minimum door height of 27 feet 3 inches. The import/export trolley has a width of 12 feet (see section 4.1.5). This width, in addition to a clearance on both sides of 1 foot, yields a minimum door width of 14 feet.

6.2.1.2 Mobile Elevating Platform

Transport Casks, MSCs, and Waste Packages that arrive in the Preparation Area prior to transfer require several operations performed upon them prior to waste transfer in the Fuel Transfer Cell. These operations include Transport Cask lid unbolting, Transport Cask/MSC gas sampling, and docking ring attachment for all waste vessels. Operations performed after waste transfer include docking ring removal for all waste vessels, inert gas backfill for the MSC prior to waste aging, Transport Cask restoration, and lid attachment (bolting). All of these operations require personnel to access the top of the waste vessel, and therefore necessitate a Mobile Elevating Platform. This platform is a duplicate piece of equipment as described in section 6.1.1.2, an Actuated Boom Man Lift. The Actuated Boom Man Lift also allows radiological surveys and possible area-specific light decontamination after/during Preparation operations.

The Mobile Elevating Platform (Actuated Boom Man Lift) has dimensions as previously described in section 5.17.

6.2.2 Space Required for Preparation Area

A sketch was used to determine if the necessary equipment fits within the equipment envelope stated in section 5.11. All necessary equipment fits within this stated envelope, as shown in Attachment II.

6.3 MAIN TRANSFER MAINTENANCE ROOM

The Fuel Handling Facility requires an area that allows easy personnel access to the overhead bridge crane that services the Main Transfer Room. This room also supports several Preparation Area functions. These functions include gas sampling and cask lid preparation. This area of the facility satisfies the criteria of sections 4.2.1, 4.2.6, 4.2.8, and 4.2.11.

6.3.1 Philosophy and Equipment

The Main Transfer Maintenance Room is located directly above the Preparation Area and is equipped with a pass-through port in the floor to allow for additional cask preparation activities. This port allows the easy removal and temporary storage of a cask lid and cask/WP/MSC docking rings in the Main Transfer Maintenance Room. A small overhead bridge crane within the Main Transfer Maintenance Room provides this function. This port also allows access to the gas sampling ports of the transport casks. A sampling of the inert gas inside the transport cask is required prior to fuel/waste transfer inside a Fuel Transfer Room.

6.3.1.1 Overhead Crane

A hoist or crane with a capacity of 20 tons (see section 4.1.7) is required to lift the Transportation Cask Docking Rings for attachment/removal. This hoist will be used for the lifting and placement of docking rings, cask lids, and other equipment either stored in the Main Transfer Maintenance Room or lowered/raised from the Preparation Area. This hoist must be proven capable of all necessary lifting operations in the Crane Maintenance/Preparation Areas.

The Main Transfer Room requires an overhead bridge crane with a 200-ton capacity (see section 4.2.16). An overhead bridge crane with a capacity of 200 tons typically has an auxiliary hoist. Section 4.2.16 states that the Main Transfer Bridge Crane is to be equipped with a 15-ton auxiliary hoist. However, bridge cranes of this capacity typically have auxiliary hoist capacities of 30 tons (Ref. 167191, p. 72). It follows that the auxiliary hoist of the Main Transfer Room Bridge Crane may be used for all lifting operations in the Main Transfer Maintenance Room and Preparation Area.

For lifting operations in the Main Transfer Maintenance Room, the Main Transfer Room Overhead Crane is moved through the Main Transfer Room Crane Access Door (see section 6.3.1.2) and into the Main Transfer Maintenance Room. To determine the feasibility of using the auxiliary hoist in the Main Transfer Maintenance Room, it is necessary to determine a lift scenario that requires the largest envelope. The Transportation Cask and MSC docking rings are to be the largest items lifted in the Main Transfer Maintenance Room (see section 6.3.1.5), at 120 inches in diameter. These docking rings are to be lifted with a sling. Section 5.23 states the assumption that typical slings have load paths that are not less than 45 degrees from the top of the load. It follows that this load configuration can be represented by an isosceles triangle with 2 forty-five degree angles and 1 ninety-degree angle. The height of this rigging, i.e. the distance from the load to the hook, is therefore equivalent to the base length of the representative triangle, which is equivalent to half of the diameter of the docking ring, at 60 inches (5 feet). Allowing for 3 feet of lift above the floor (elevation – 32') yields a necessary high-hook elevation for the auxiliary hoist of 40 feet. The necessary distance from this auxiliary high-hook elevation to the top of the trolley is 10 feet 8 inches (Ref. 167191, p. 73), yielding the top of trolley elevation of

50 feet 8 inches. This is the minimum elevation of the structural steel members that support the ceiling of the Main Transfer Maintenance Room.

To find the elevation of the structural steel members in the Main Transfer Maintenance Room, known elevations must be summed. A floor height for the Main Transfer Maintenance Room is found by adding the 28 ft. height envelope of the Preparation Area given in section 5.11 with the 4 ft. depth given in section 5.22. This places the Main Transfer Maintenance Room floor elevation at 32 feet. With a usable height envelope of 26 feet (see section 5.12), the elevation of the structural steel is placed at 58 feet, which is 7 feet 4 inches higher than the top of the Main Transfer Room Overhead Crane trolley. It follows that there is enough height available to accommodate the worst-case lifting scenario described above. Hook approaches must also be examined to prove the feasibility of using the auxiliary hoist of the Main Transfer Room Overhead Crane for Preparation operations.

Hook approaches are also examined to prove the auxiliary hoist capability. The hook approach in the direction of the rails is 14 feet (Ref. 167191, p. 73). The room is 34 feet wide (see section 5.12), which leaves 20 feet of room width in which to place equipment with the auxiliary hoist. The crane rails are a minimum of 14 inches from the walls. This value is a combination of the 2-inch minimum distance between the girder and the wall (Ref. 167191, p. 72) and the distance from the end of the girder to the rail center is 12 inches (Ref. 167191, p. 72). The sum of these two values yields a distance of the rail center to the wall of 14 inches. The hook approaches are different depending on which side of the room that the trolley is closest to, due to the hook offset. One side of the room will have a auxiliary hook approach of 13 feet (taken from the rail center), which when added to the 14-inch value as discussed previously, yields a total auxiliary hook approach of 14 feet 2 inches. This is the larger of the two hook approaches, due to the hook offset. The auxiliary hook is offset 6 feet from the main hook (Ref. 167191, p. 73). The other main hook approach for the crane is 9 feet (Ref. 167191, p. 72). This value, when added to the 14-inch value discussed previously, yields a main hook approach value of 10 feet 2 inches for the other side of the room. Subtracting the hook offset described previously from this value yields the auxiliary hook approach for the other side of the room, 4 feet 2 inches. These hook approaches are detailed in Attachment 2.

6.3.1.2 Main Transfer Crane Maintenance Door

The Main Transfer Room Overhead Crane has access to the Main Transfer Maintenance Room through the Main Transfer Crane Maintenance Door. This door is a large rolling steel door that in the course of everyday operations is generally closed.

The Main Transfer Room Overhead Crane must be able to access the Main Transfer Maintenance Room through the Maintenance Door, which therefore is sized accordingly. The Main Transfer Room is assumed to be 64 feet in width, and therefore the Main Transfer Room Overhead Crane will require most of this width. The Main Transfer Crane Maintenance Door is assumed to be of this same width to allow the maximum amount of room for the Main Transfer Room Crane. Girder depth for the Main Transfer Room Crane is unknown, as they will be sized during detailed design, and therefore the necessary Main Transfer Crane Maintenance Door height is unknown at this time.

6.3.1.3 Tool Station

The Tool Station is necessary to store the pneumatic impact torque/de-torque device and associated sockets, as well as the quick connects for service air.

The floor space required for the Tool Station is as stated in section 5.21.

6.3.1.4 NAC-STC Outer Lid

A single Transport Cask, the NAC-STC, has an outer lid as well as an inner lid. This outer lid must be stored prior to waste transfer operations. A logical place for this lid to be stored is in the Main Transfer Maintenance Room. After waste transfer operations, the lid is lowered through the access port and re-affixed to the NAC-STC Transport Cask. This lid is 85.7 inches in diameter (see section 4.1.8).

6.3.1.5 Transport Cask Docking Ring

The docking ring for the largest Transport Cask is sized as follows (in conjunction with the assumption stated in section 5.13):

$$79.88in + 40in \approx 120in$$

79.88 inches is the diameter of the lid of the TN-68 Transport Cask (Ref. 160746, Drawing 972-71-4).

6.3.1.6 Waste Package Docking Ring

All Transport Casks and Waste Packages require a docking ring to be affixed as an interface between the Transport Cask/MSC/WP and the Fuel Transfer Cell prior to spent fuel transfer. The size of these docking rings must be assumed, and 3 docking rings (one for the specific Transport Cask, MSC, and WP to be used in a single fuel transfer operation) must be staged prior to a fuel transfer in the Fuel Transfer Cell. The docking rings are to be staged in the Main Transfer Maintenance Room prior to a fuel transfer operation. The docking ring for a Waste Package is sized as follows (in conjunction with the assumption stated in section 5.13):

$$75.38in + 40in \approx 115in$$

75.38 inches is the diameter of the inner lid of the 5 DHLW/DOE Waste Package (Ref 168247). This is the largest diameter Waste Package, and is the maximum diameter lid to be picked up by a docking ring, therefore, the Waste Package Docking Ring size is based upon this value.

6.3.1.7 MSC Docking Ring

The MSC Docking Ring dimensions are no larger than the calculated dimensions of the Transport Cask Docking Ring (see sections 5.14).

6.3.1.8 Cask Access Port Cover

A cover is required to minimize the possible spread of contamination during operations that do not require the Cask Access Port described in section 6.3.2. It requires a floor space of 12 feet 6 inches by 12 feet 6 inches.

6.3.1.9 Gas Analysis Station

Equipment located at the Gas Analysis Station is used to sample the gas inside Transportation Casks prior to fuel/canister transfer. This equipment is necessary to determine the condition of the contents of the cask.

The floor space required for the Gas Analyzer is as stated in section 5.20.

6.3.2 Space Required for Main Transfer Maintenance Room Equipment

The opening in the floor (Cask Access Port) is required to be larger than the largest item lifted/lowered through it. The largest item lifted/lowered through this opening is the docking ring for the Transport Cask, at 120 inches in diameter. Allowing a foot clearance on each side of this docking ring as it is lifted/lowered through the opening, yields an opening that is 144 inches (12 feet) square. This opening is centrally located in the floor.

A sketch was used to determine if the necessary equipment fits within the equipment envelope stated in section 5.12. All necessary equipment fits within this stated envelope, as shown in Attachment II, and all equipment that must be lifted fits within the hook approaches as described in section 6.3.1.1. Many pieces of equipment will not be necessary for all operations that take place in the Main Transfer Maintenance Room. For example, the floor space allocated for the outer lid of the NAC-STC Transportation Cask will be unnecessary if this type of cask is not being handled by the FHF. These pieces of equipment can be either removed to a storage facility or placed outside until they are required.

7. RESULTS

The assumptions made in regards to Vestibule, Preparation Area, and Main Transfer Maintenance Room working equipment envelope sizes (see sections 5.10, 5.11, 5.12) are accurate in the sense that these envelopes are the minimum envelopes that allow the required functionality of these areas in the Fuel Handling Facility. The required equipment for these areas proves the overall feasibility of these assumptions and the functionality of the rooms that it occupies.

The equipment required and described by this calculation for the Vestibule, Preparation Room, and Main Transfer Maintenance Room is summarized in the following table:

Table 4: Equipment Summary

	Equipment No.	Equipment Title	Description	See Section
Vestibule Equipment	210-MJ-HMH0-CRN00001	Vestibule Gantry Crane	Crane	6.1.1.1
	210-AK-HM00-SHDR0001	Preparation Equipment Door	Shielded Equipment Door	6.1.1.16
	210-MJ-HMH0-GRPL0001	Impact Limiter Lifting Device	Lift Adapter	6.1.1.5
	210-MJ-HMH0-GRPL0002	Personnel Barrier Lifting Device	Lift Adapter	6.1.1.4
	210-MJ-HMH0-WPTS0001	Cask Tilting Device	Remote Handling Equipment	6.1.1.7
	TBD	HI-STAR Lift Yoke	Lift Adapter	6.1.1.6
	210-MQ-HMH0-LFTD0001	Mobile Elevating Platform	Maintenance Equipment	6.1.1.2
	TBD	Cask Lift Yoke	Lift Adapter	6.1.1.8
	TBD	Waste Package Lift Yoke	Lift Adapter	6.1.1.9
	TBD	Cask Pedestal Lifting Device	Lift Adapter	6.1.1.10
	TBD	Transport Cask Pedestal Set	Pedestal Set	6.1.1.11
	TBD	MSC Pedestal Set	Pedestal Set	6.1.1.12
	210-MQ-HMH0-TT000005	Import/Export Trolley	Trolley	6.1.1.14
	TBD	Vestibule Outer Door	Shielded Equipment Door	6.1.1.3
Prep. Room Equipment	210-AK-HM00-SHDR0003	Main Transfer Room Equipment Door	Shielded Equipment Door	6.2.1.1
	210-MQ-HMH0-LFTD0003	Mobile Elevating Platform	Maintenance Equipment	6.2.1.2
Main Transfer Maintenance Rm.	210-AK-HM00-SHDR0010	Main Transfer Crane Maintenance Door	Shielded Equipment Door	6.3.1.2
	TBD	Cask Access Port Cover	Cover	6.3.1.8

7.1 RECOMMENDATION

Further analysis of the Main Transfer Maintenance Room and its envelope is required to prove the feasibility of a small capacity lifting device (20 tons or less) that would allow the Main Transfer Room Overhead Bridge Crane to stay inside the Main Transfer Room except for maintenance.

8. REFERENCES

NOTE: References included in this document are extracted from the BSC Document Input Reference System (DIRS) database, and are presented in this section in order of the unique reference number assigned by the DIRS.

Reference No.	Reference Title
103042	General Atomics. 1998. *GA-4 Legal Weight Truck Spent Fuel Shipping Cask, Safety Analysis Report for Packaging (SARP).* 910469/H. Two volumes. San Diego, California: General Atomics. TIC: 245137.
104776	General Atomics. 1993. *GA-9 Legal Weight Truck From-Reactor Spent Fuel Shipping Cask, Final Design Report.* 910354/0. San Diego, California: General Atomics. ACC: NNA.19940513.0214.
104787	10 CFR 20. Energy: Standards for Protection Against Radiation. Readily available.
160746	Transnuclear 2001. *TN-68 Transport Packaging Safety Analysis Report, Revision 4.* Hawthorne, New York: Transnuclear. TIC: 254025.
160755	*NAC (Nuclear Assurance Corporation) 2001.* Safety Analysis Report for the NAC-LWT Legal Weight Truck Cask, Revision 33. *Atlanta, Georgia: NAC International. TIC: 254018.*
161362	Minwalla, H.J. 2003. *Project Design Criteria Document.* 000-3DR-MGR0-00100-000-001. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20030402.0001.
163904	Siddoway, D.W. 2003. *Project Functional and Operational Requirements.* TDR-MGR-ME-000003 REV 01. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20030630.0001.
164612	NAC International. 2002. *Safety Analysis Report for the UMS® Universal Transport Cask.* UMST-02E. EA790-SAR-001. Docket No. 71-9270. Volume 1. Norcross, Georgia: NAC International. TIC: 254855.
165179	BSC (Bechtel SAIC Company) 2003. *Q-List.* TDR-MGR-RL-000005 REV 00. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20030930.0002.
165219	McKenzie, J.M. 2002. Naval Nuclear Propulsion Program Technical Baseline Compliance Document, Revision 1, October 2002. Letter from J.M. McKenzie (DOE) to J. Williams (DOE/OCRWM), November 19, 2002, NR:RA:RWIshihara U#02-2852, with enclosure. ACC: HQO.20030502.0028; HQO.20030502.0029.

166136 KASGRO Rail Car Management. 2003. Rail Car Specification Manual, KRL & LNAL Heavy Duty Rail Cars. [Ramsey, Indiana]: KASGRO Rail Car Management. TIC: 255162.

166275 Canori, G.F. and Leitner, M.M. 2003. *Project Requirements Document.* TER-MGR-MD-000001 REV 02. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20031222.0006.

167124 Arthur, W.J., III 2004. "Authorization for Bechtel SAIC Company, LLC (BSC), to Include a Bare Fuel Handling Facility (BFHF) and Increased Aging Capacity in the License Application, Contract Number DE-AC28-01RW12101." Letter from W.J. Arthur, III (DOE/ORD) to J.T. Mitchell, Jr. (BSC), January 27, 2004, 0127040240, OLA&S:PGH-0612, with enclosure. ACC: MOL.20040202.0101.

167191 Weaver, W.M. 1985. "Overhead Crane Handbook." *Sections I through VI.* 4th Edition. Pages 6-85. Harvey, Illinois: Whiting Corporation. TIC: 255506.

168043 Cogema. 2004. *Cask/MSC/WP Preparation System Cask Trolley Mechanical Equipment Envelope.* YMP-C0115-0701, Rev. C. Las Vegas, Nevada: Cogema. ACC: ENG.20040225.0004.

168247 BSC (Bechtel SAIC Company) 2004. *Design and Engineering, Inner Vessel Lid.* 000-MW0-MGR0-01201-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20040308.0020.

168412 LP-SI.11Q-BSC, Rev. 0, ICN 0. *Software Management.* Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: DOC.20040225.0007.

168413 AP-3.12Q, Rev. 2, ICN 2. *Design Calculations and Analyses.* Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: DOC.20040318.0002.

168669 DOE (U.S. Department of Energy) 2004. *Quality Assurance Requirements and Description.* DOE/RW-0333P, Rev. 14. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: DOC.20040331.0004.

168721 BSC (Bechtel SAIC Company) 2004. Addition of a Fuel Handling Facility/Central Control Center. Baseline Change Proposal (BCP), YMP-2004-072. Las Vegas, NV: Bechtel SAIC Company.

168751 Powers, K.W. 2004. "Technical Direction to Bechtel SAIC Company, LLC (BSC) for Surface Facility Improvements, Contract Number DE-AC28-01RW12101; TDL No. 04-024." Letter from K.W. Powers (DOE/ORD) to J.T. Mitchell, Jr. (BSC), February 19, 2004, 0220040510, OLA&S:PGH-0723. ACC: MOL.20040324.0199.

168931 Cogema. 2004. *Cask/MSC/WP Preparation System Cask Lifting Yoke Mechanical Equipment Envelope.* YMP-C0115-0746, Rev. A. Las Vegas, Nevada: Cogema. ACC: ENG.20040419.0023.

168932 Cogema. 2004. *SNF/HLW Transfer System WP Lifting Yoke Mechanical Equipment Envelope.* YMP-C0115-0756, Rev. A. Las Vegas, Nevada: Cogema. ACC: ENG.20040410.0022.

168964 Cogema. 2003. *Cask Receipt and Return System Block Flow Diagram Level 2.* YMP-C0115-0502, Rev. G. Las Vegas, Nevada: Cogema. ACC: ENG.20040123.0035.

169135 Cogema 2003. *Cask/MSC/WP Preparation System Block Flow Diagram Level 2.* YMP-CO115-0504 Rev. G. Las Vegas, NV: Cogema.

169136 Cogema. 2003. *SNF/HLW Transfer System Block Flow Diagram.* YMP-C0115-0506, Rev. B. Las Vegas, Nevada: Cogema. ACC: ENG.20040123.0076.

169158 Cogema 2004. *Cask/MSC/WP Preparation System WP Trolley Pedestal Mechanical Equipment Envelope.* YMP-CO115-0752 Rev. A. Las Vegas, NV: Cogema. ACC: ENG.20040419.0024.

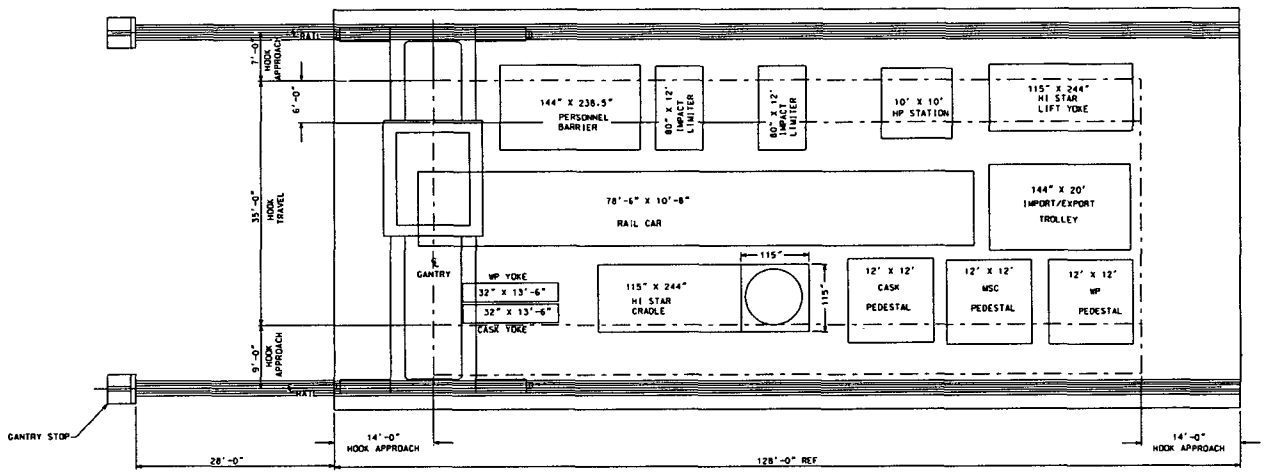
160757 BNFL Fuel Solutions. 2002. *FuelSolutions™ TS125 Transportation Cask Safety Analysis Report, Revision 3.* WSNF-120. Docket No. 71-9276. Scotts Valley, California: BNFL Fuel Solutions. TIC: 254026.

169235 Gutherman, B. 2003. "USNCR Docket No. 71-9261, HI-STAR 100 Certificate of Compliance 9261, Submittal of HI-STAR 100 Safety Analysis Report, Revision 10." Letter from B. Gutherman (Holtec) to the NRC, August 21, 2003, with enclosures. TIC: 255249.

169335 Cogema. 2004. *Cask/MSC/WP Preparation System Cask Docking Ring Crane 20 Tons Mechanical Equipment Envelope.* YMP-CO115-0751, Rev. A. Las Vegas, Nevada: Cogema. ACC: ENG.20040419.0022.

169362 Thompson, T.C. 2003. "NAC-STC Safety Analysis Report, Revision 14." Letter from T.C. Thompson (NAC International) to the NRC, June 18, 2003, with enclosures. TIC: 255255.

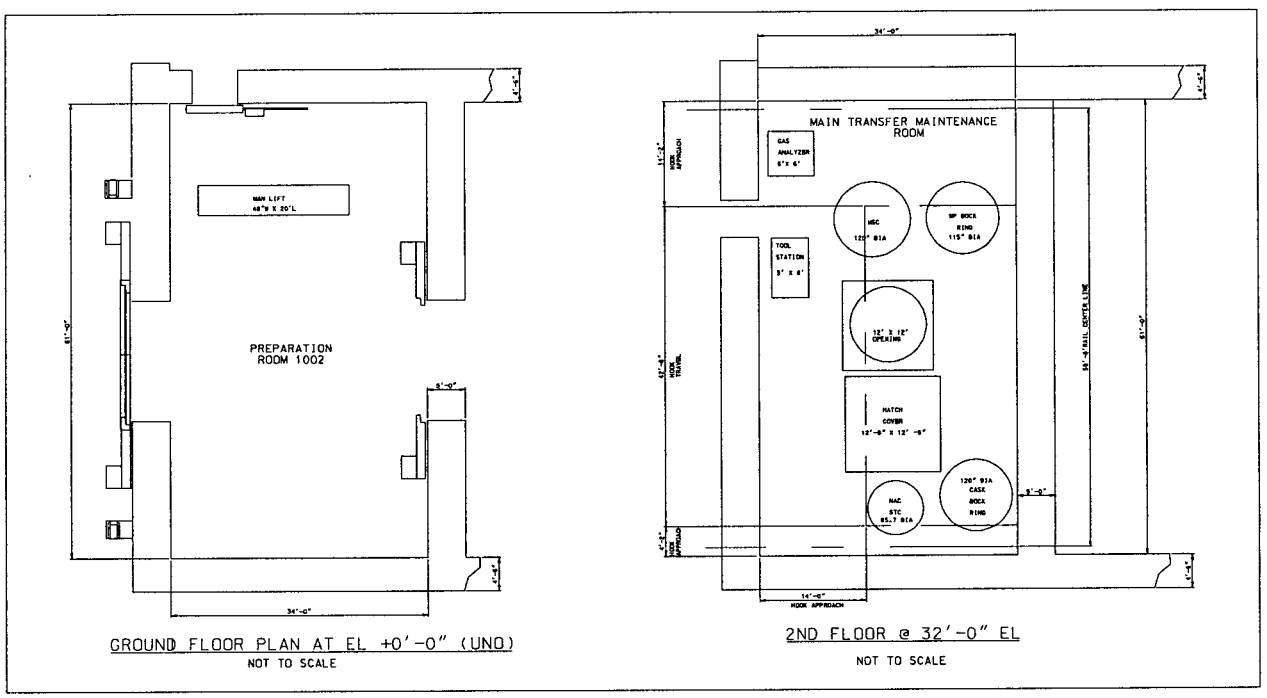
ATTACHMENT I:
VESTIBULE EQUIPMENT LAYOUT



PLAN VIEW
SCALE: NOT TO SCALE
FHF VESTIBULE

ATTACHMENT II:

PREPARATION AREA & MAIN TRANSFER MAINTENANCE ROOM EQUIPMENT LAYOUTS



GROUND FLOOR PLAN AT EL +0'-0" (UNO)
NOT TO SCALE

2ND FLOOR @ 32'-0" EL
NOT TO SCALE